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Communication apparatus and method of displaying images

Abstract:

Abstract of GB2352938

A newly received message is compared with formerly received messages which are stored in a memory. At the time of arrival of the newly received message, a portion of the message that is unchanged as compared to a formerly received message is displayed in a normal manner. Changed message portions may be displayed in different colours in order to highlight changing information such as rising or falling share prices. The colour of message portions may also be determined in relation to times of arrival and reading of messages.

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(54) Abstract Title
Communication apparatus and method of displaying images

(57) A newly received message is compared with formerly received messages which are stored in a memory. At the time of arrival of the newly received message, a portion of the message that is unchanged as compared to a formerly received message is displayed in a normal manner. Changed message portions may be displayed in different colours in order to highlight changing information such as rising or falling share prices. The colour of message portions may also be determined in relation to times of arrival and reading of messages.

FIG.5

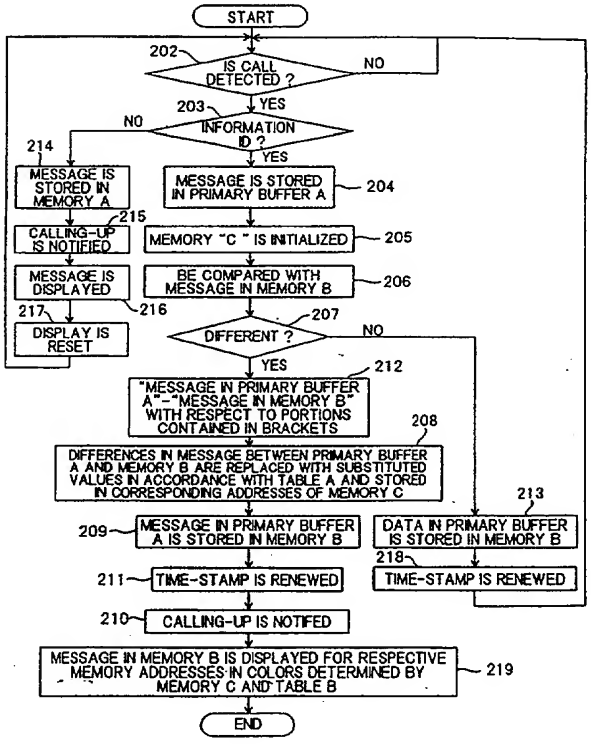

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FIG.1 PRIOR ART

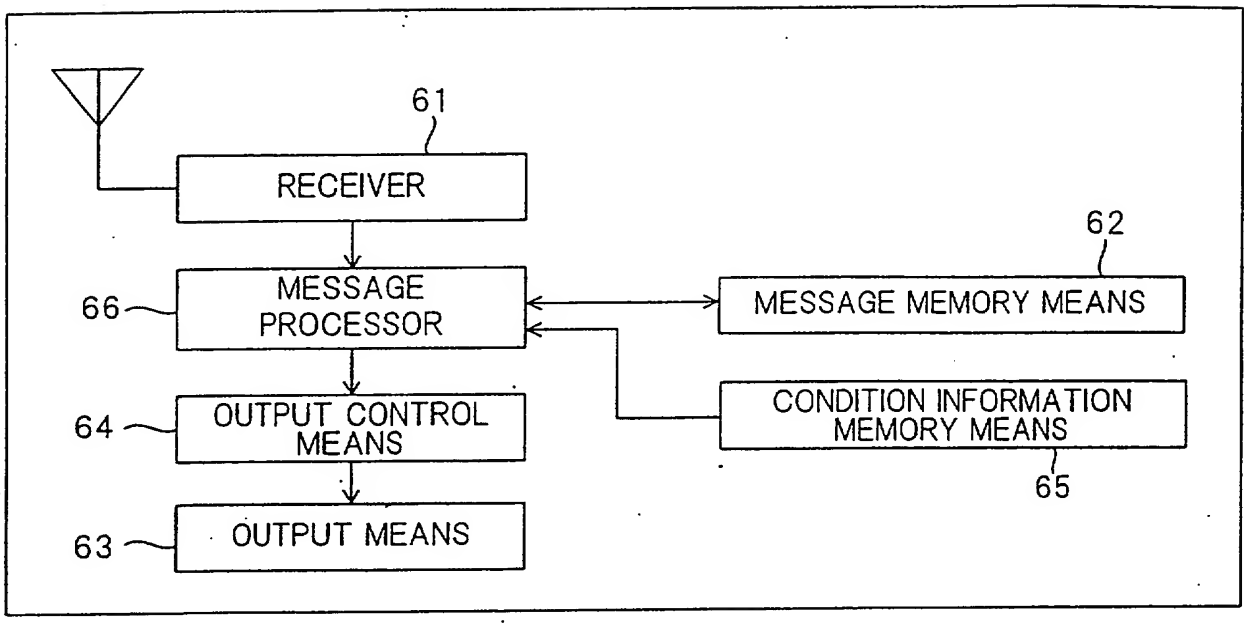


FIG.2A PRIOR ART

ISSUE	PRICE
Y Y Y	100
Z Z Z	80

FIG.2B PRIOR ART

ISSUE	PRICE
Y Y Y.	150
Z Z Z	80

FIG.3

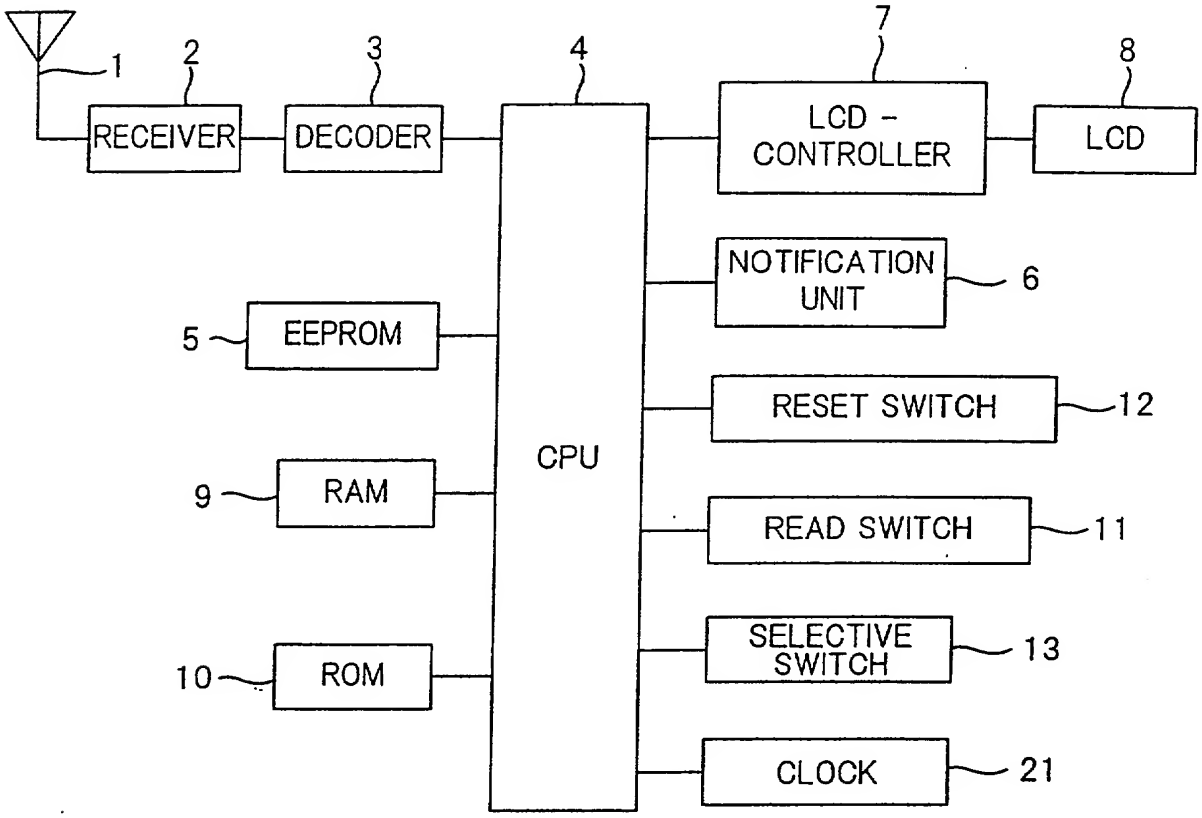

1
2
3
4
7
8
RECEIVER
DECODER
CPU
LCD - CONTROLLER
LCD
NOTIFICATION UNIT
6
5
EEPROM
RESET SWITCH
12
9
RAM
READ SWITCH
11
10
ROM
SELECTIVE SWITCH
13
CLOCK
21

FIG. 4

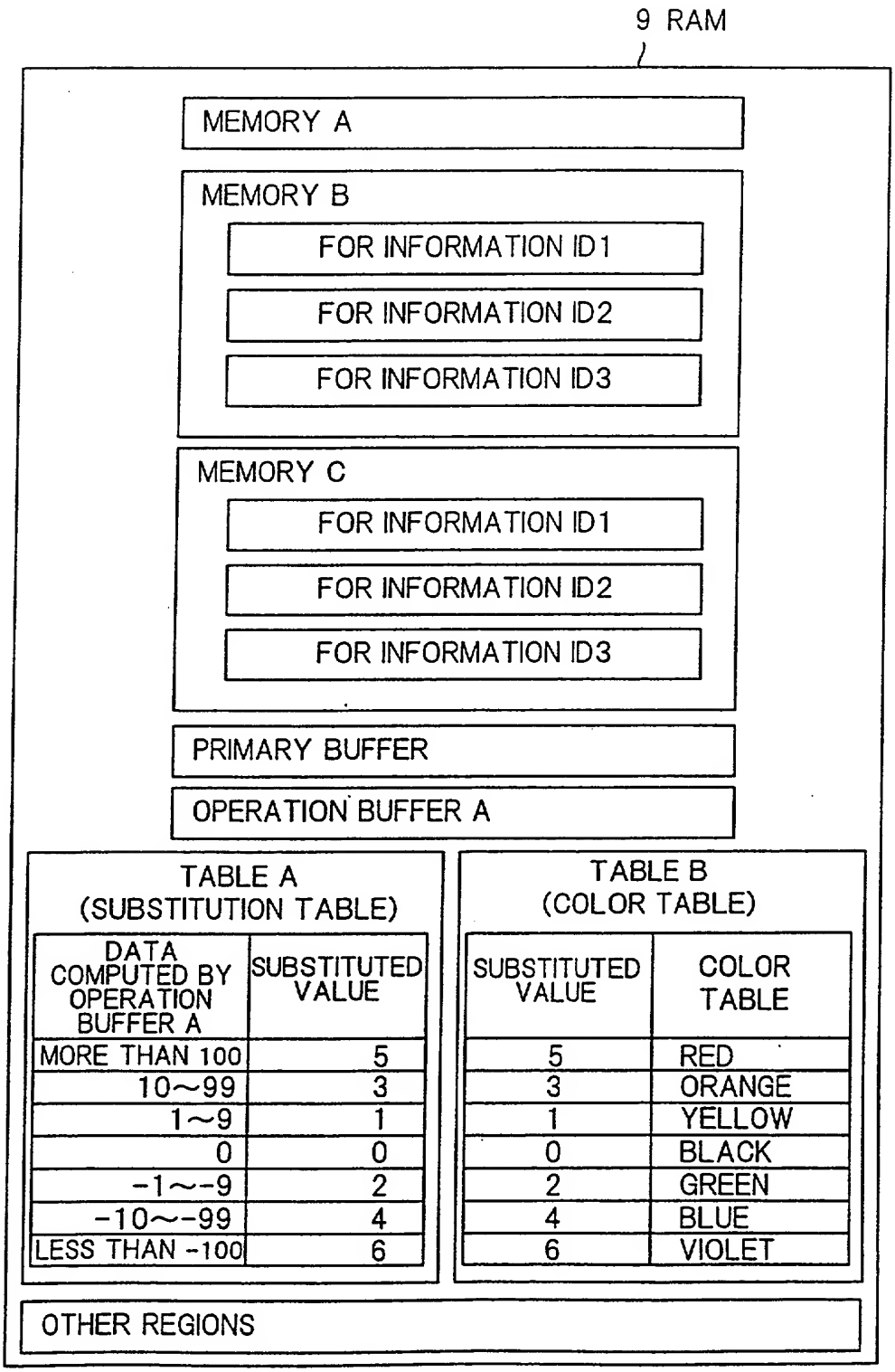

9 RAM
MEMORY A
MEMORY B
FOR INFORMATION ID1
FOR INFORMATION ID2
FOR INFORMATION ID3
MEMORY C
FOR INFORMATION ID1
FOR INFORMATION ID2
FOR INFORMATION ID3
PRIMARY BUFFER
OPERATION BUFFER A
TABLE A
(SUBSTITUTION TABLE)
DATA COMPUTED BY OPERATION BUFFER A
SUBSTITUTED VALUE
MORE THAN 100 5
10~99 3
1~9 1
0 0
-1~-9 2
-10~-99 4
LESS THAN -100 6
TABLE B
(COLOR TABLE)
SUBSTITUTED VALUE
COLOR TABLE
5 RED
3 ORANGE
1 YELLOW
0 BLACK
2 GREEN
4 BLUE
6 VIOLET
OTHER REGIONS

FIG.5

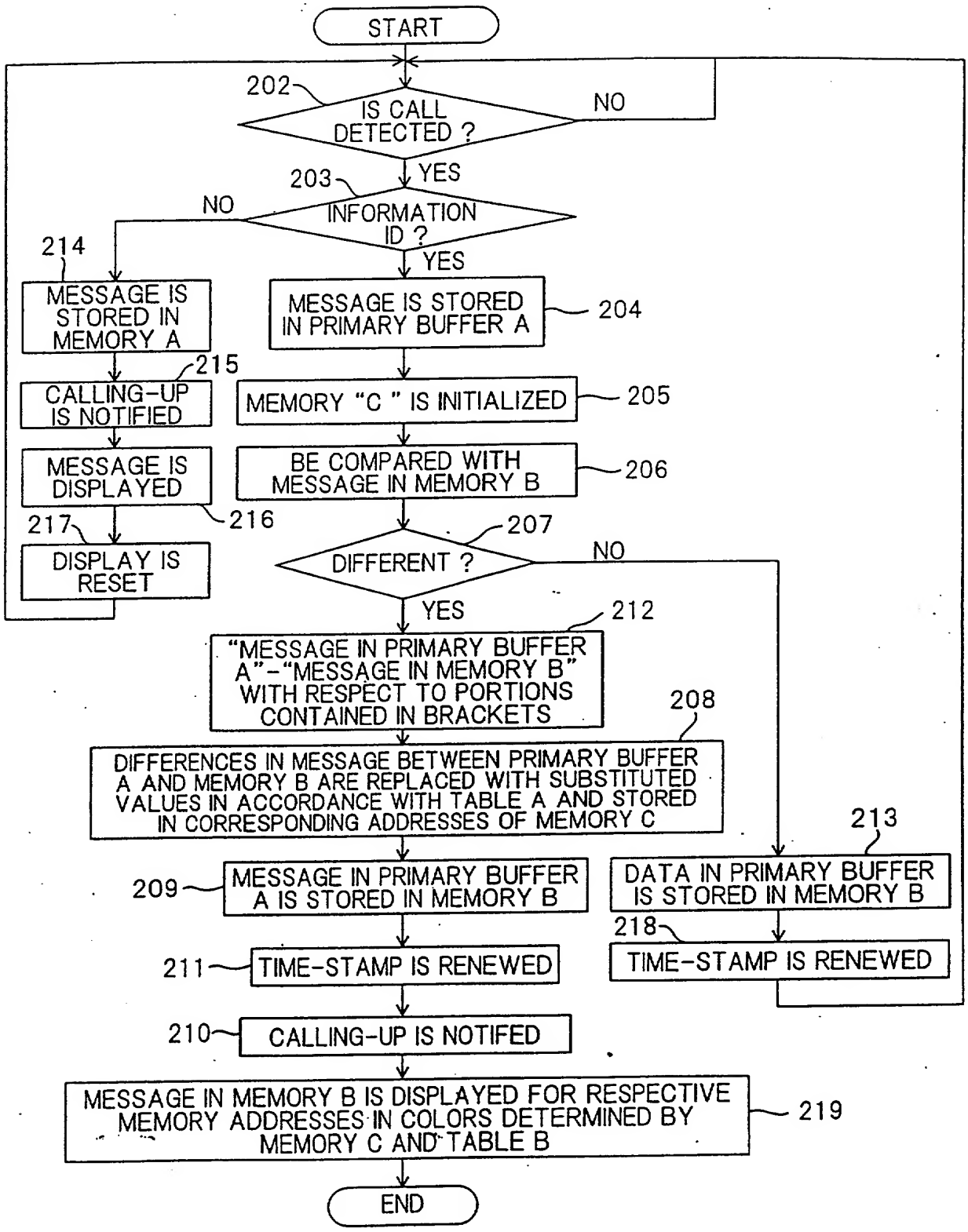

START
202
IS CALL DETECTED ?
NO
YES
203
INFORMATION ID ?
NO
YES
214
MESSAGE IS STORED IN MEMORY A
MESSAGE IS STORED IN PRIMARY BUFFER A
204
215
CALLING-UP IS NOTIFIED
MEMORY "C " IS INITIALIZED
205
MESSAGE IS DISPLAYED
BE COMPARED WITH MESSAGE IN MEMORY B
206
216
217
DISPLAY IS RESET
207
DIFFERENT ?
NO
YES
212
"MESSAGE IN PRIMARY BUFFER A"-"MESSAGE IN MEMORY B" WITH RESPECT TO PORTIONS CONTAINED IN BRACKETS
208
DIFFERENCES IN MESSAGE BETWEEN PRIMARY BUFFER A AND MEMORY B ARE REPLACED WITH SUBSTITUTED VALUES IN ACCORDANCE WITH TABLE A AND STORED IN CORRESPONDING ADDRESSES OF MEMORY C
213
209
MESSAGE IN PRIMARY BUFFER A IS STORED IN MEMORY B
DATA IN PRIMARY BUFFER IS STORED IN MEMORY B
218
211
TIME-STAMP IS RENEWED
TIME-STAMP IS RENEWED
210
CALLING-UP IS NOTIFED
MESSAGE IN MEMORY B IS DISPLAYED FOR RESPECTIVE MEMORY ADDRESSES IN COLORS DETERMINED BY MEMORY C AND TABLE B
219
END

FIG. 6A

MEMORY ADDRESS	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
PRIMARY BUFFER	α	α	(	2	2	2	)		β	β	(	3	3	3	)
MEMORY B	α	α	(	1	0	5	)		β	β	(	3	3	3	)
OPERATION BUFFER A															
MEMORY C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

FIG. 6B

MEMORY ADDRESS	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
PRIMARY BUFFER	α	α	(	2	2	2	)		β	β	(	3	3	3	)
MEMORY B	α	α	(	1	0	5	)		β	β	(	3	3	3	)
OPERATION BUFFER A				1	1	7								0	
MEMORY C	0	0	0	5	5	5	0	0	0	0	0	0	0	0	0

FIG. 7A

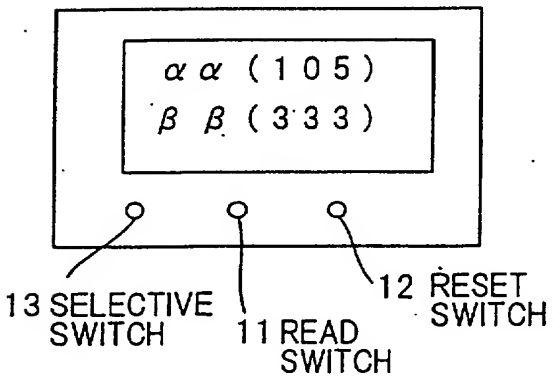


FIG. 7B

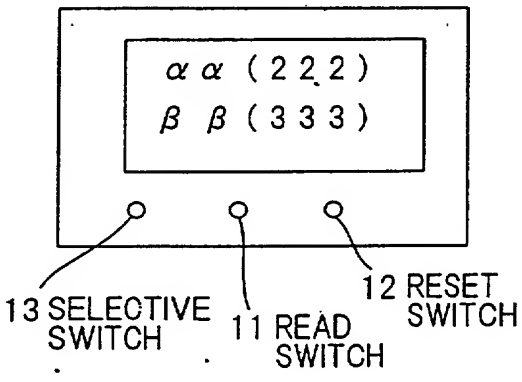


FIG.8

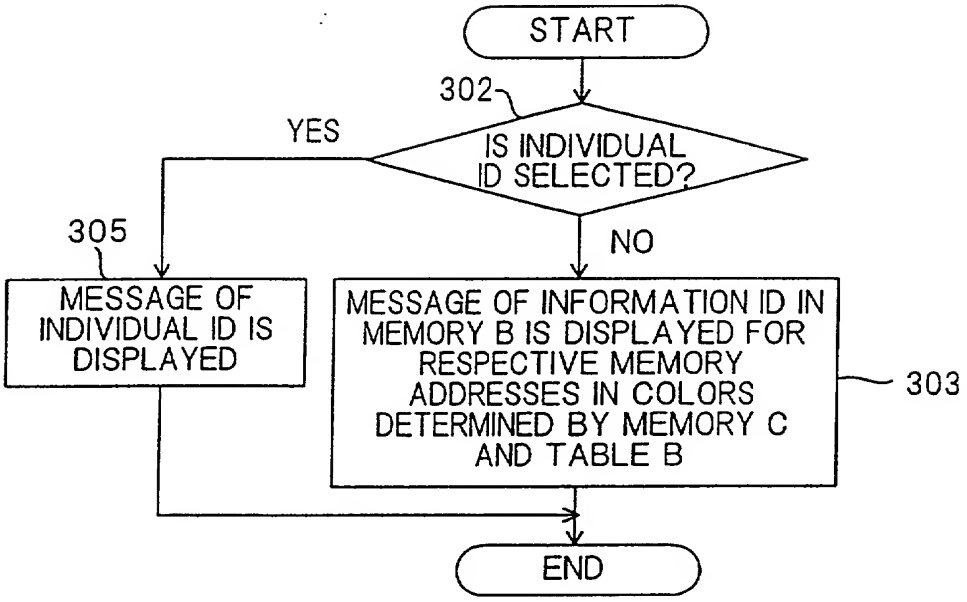

START
302
IS INDIVIDUAL ID SELECTED?
YES
NO
305
MESSAGE OF INDIVIDUAL ID IS DISPLAYED
MESSAGE OF INFORMATION ID IN MEMORY B IS DISPLAYED FOR RESPECTIVE MEMORY ADDRESSES IN COLORS DETERMINED BY MEMORY C AND TABLE B
303
END

FIG.9

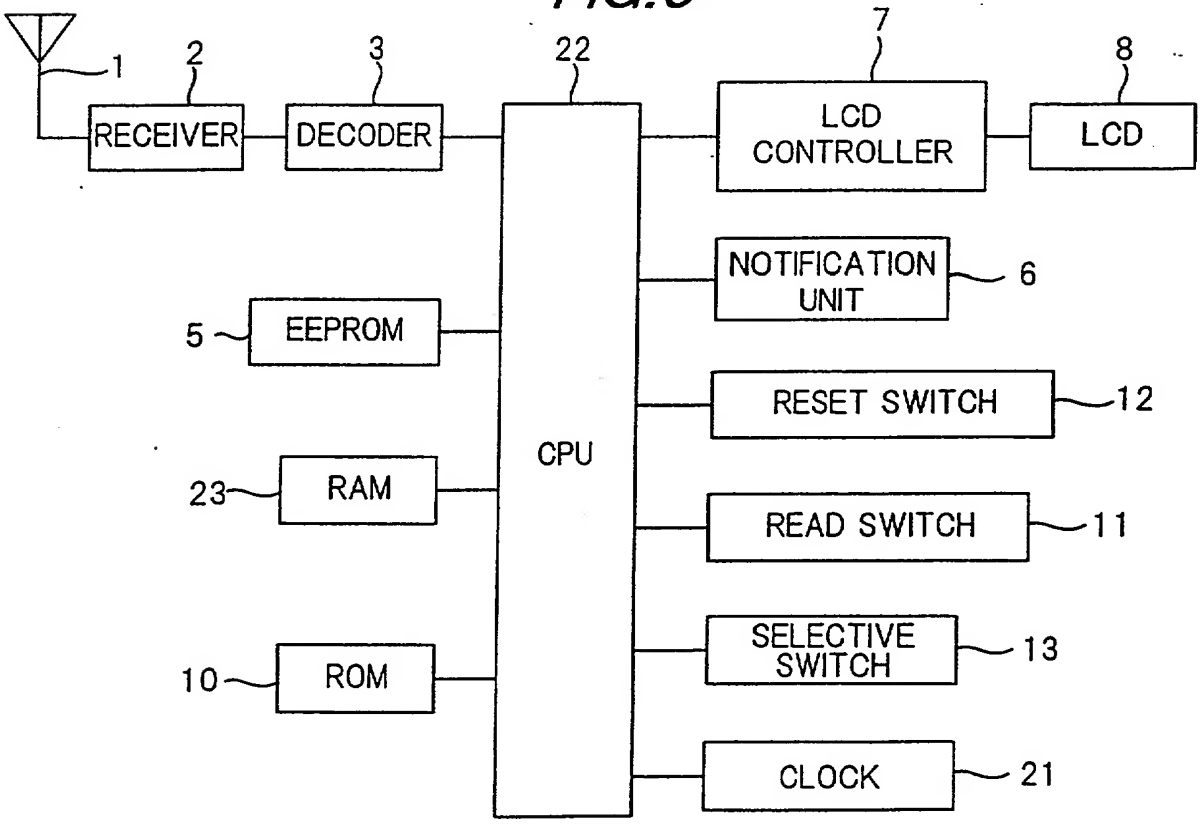

1
2
RECEIVER
3
DECODER
22
CPU
7
LCD CONTROLLER
8
LCD
NOTIFICATION UNIT
6
5
EEPROM
RESET SWITCH
12
23
RAM
READ SWITCH
11
SELECTIVE SWITCH
13
10
ROM
CLOCK
21

FIG. 10

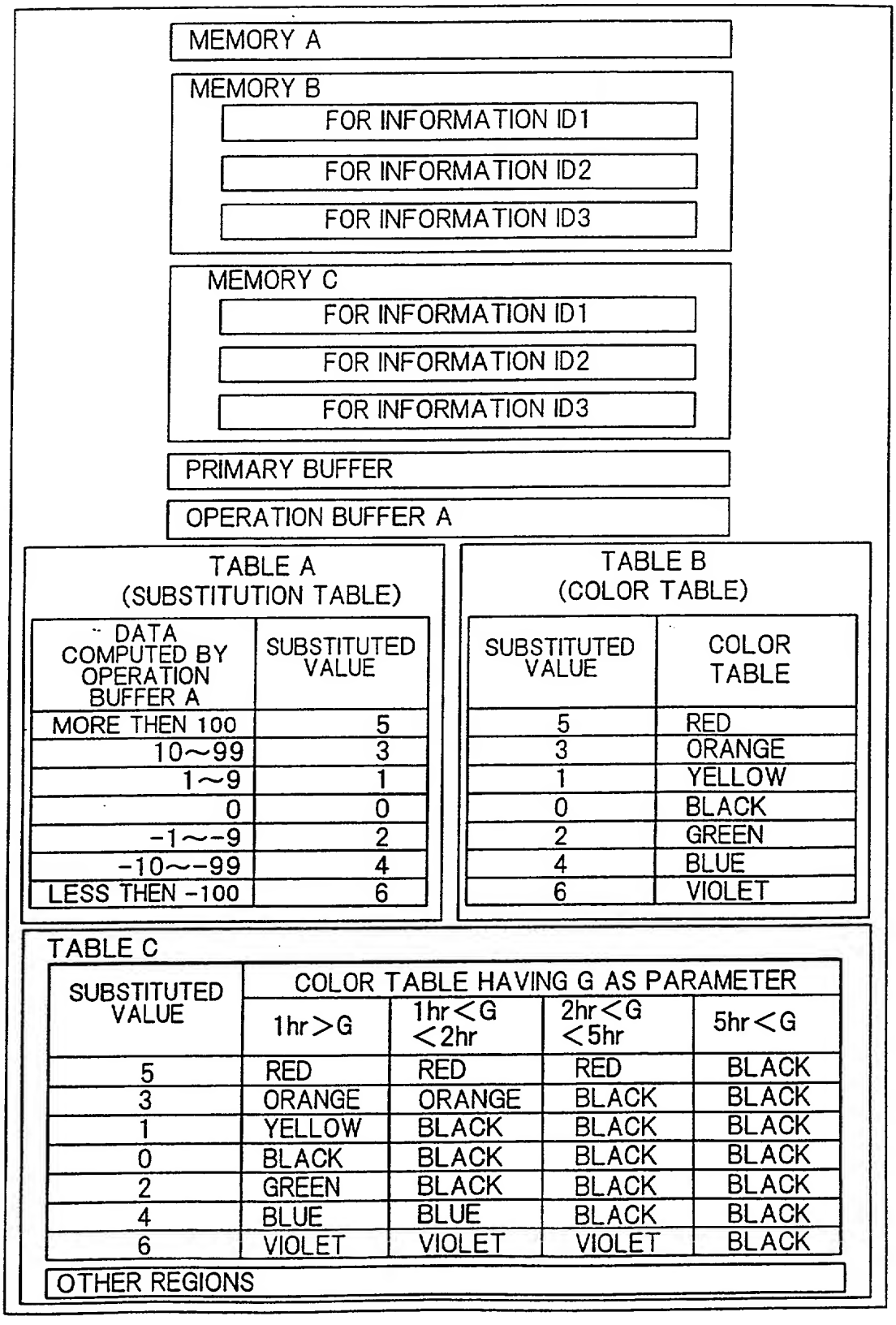


TABLE A
(SUBSTITUTION TABLE)

DATA COMPUTED BY OPERATION BUFFER A	SUBSTITUTED VALUE
MORE THEN 100	5
10～99	3
1～9	1
0	0
-1～-9	2
-10～-99	4
LESS THEN -100	6

TABLE B
(COLOR TABLE)

SUBSTITUTED VALUE	COLOR TABLE
5	RED
3	ORANGE
1	YELLOW
0	BLACK
2	GREEN
4	BLUE
6	VIOLET

TABLE C

SUBSTITUTED VALUE	COLOR TABLE HAVING G AS PARAMETER			
	1hr>G	1hr<G<2hr	2hr<G<5hr	5hr<G
5	RED	RED	RED	BLACK
3	ORANGE	ORANGE	BLACK	BLACK
1	YELLOW	BLACK	BLACK	BLACK
0	BLACK	BLACK	BLACK	BLACK
2	GREEN	BLACK	BLACK	BLACK
4	BLUE	BLUE	BLACK	BLACK
6	VIOLET	VIOLET	VIOLET	BLACK

OTHER REGIONS

FIG. 11

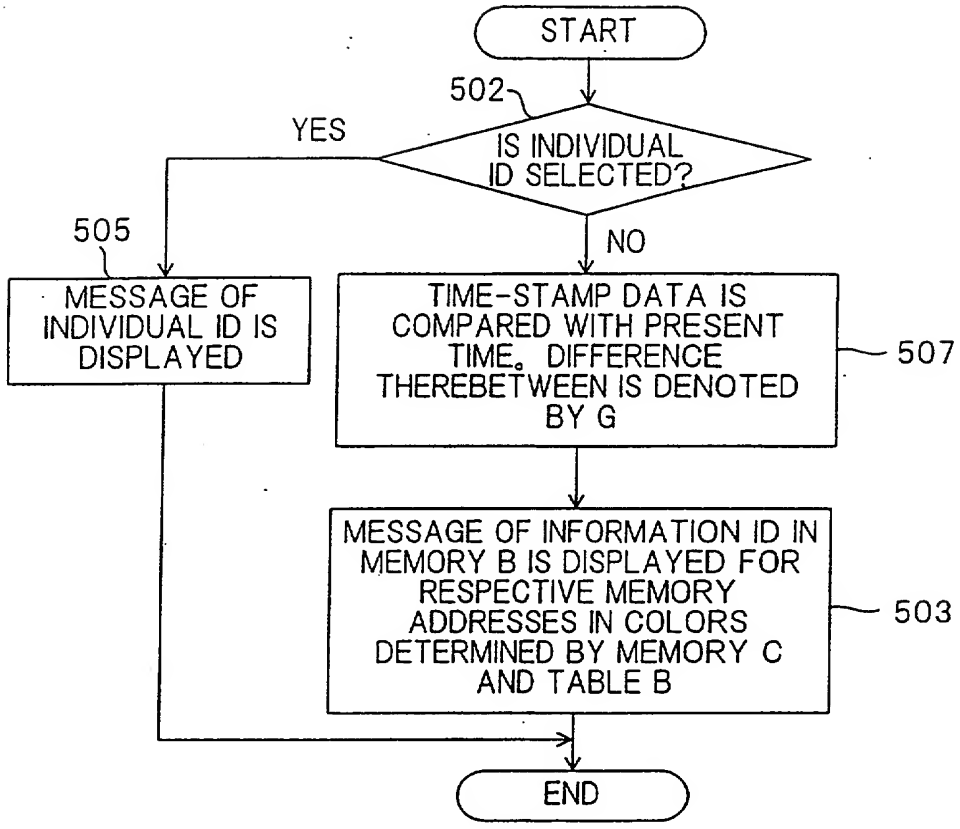
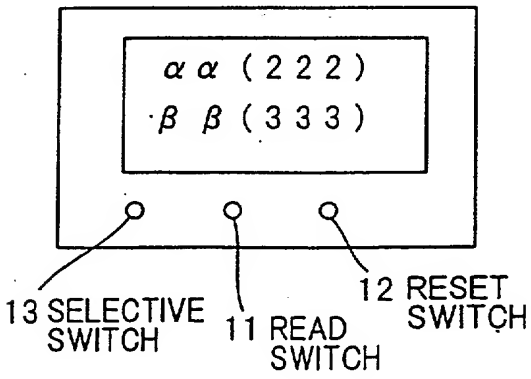

START
502
IS INDIVIDUAL ID SELECTED?
YES
NO
505
MESSAGE OF INDIVIDUAL ID IS DISPLAYED
TIME-STAMP DATA IS COMPARED WITH PRESENT TIME。DIFFERENCE THEREBETWEEN IS DENOTED BY G
507
MESSAGE OF INFORMATION ID IN MEMORY B IS DISPLAYED FOR RESPECTIVE MEMORY ADDRESSES IN COLORS DETERMINED BY MEMORY C AND TABLE B
503
END

FIG. 12


α α (222)
β β (333)
13 SELECTIVE SWITCH
11 READ SWITCH
12 RESET SWITCH

WIRELESS COMMUNICATION APPARATUS AND METHOD FOR DISPLAYING A MESSAGE USED IN THE APPARATUS

FIELD OF THE INVENTION

The invention relates to a wireless communication apparatus and a method for displaying a message used in the same, and especially to a wireless communication apparatus for displaying information transmitted from a base station and a method for displaying a message used in the same.

BACKGROUND OF THE INVENTION

Hitherto, according to a wireless communication apparatus, a paging receiver for instance, a user can receive information on a hourly changing price of a stock at predetermined times or a certain interval if he desires.

In the paging receiver, if the price of the stock is displayed unchanged, the user cannot recognize a relation between information of the price of the stock newly displayed and that formerly displayed.

According to a paging receiver disclosed in Japanese patent application, laid-open, No. 10-304418, when a receiving means 61 receives a message, a message-processor 66 compares the newly-received message with the formerly received message which has been stored in a message-memory means 62, as shown in FIG.1. When a difference therebetween satisfies a predetermined condition stored in a condition information-memory means 65, an output-control means 64 so controls an output means 63 that the newly received message

is displayed in a reversal color.

For example, as shown in FIG.2A, if a message that a price of an issue YYY is "100" and that of an issue ZZZ is "80" is received, the received message A is outputted to the output means 63, and stored in the message-memory means 62. Thereafter, a message B that the price of the issue YYY is "150" and that of the issue ZZZ is "80" is received by the receiving means 61. The message-processor 66 compares the message A with the message B. As a result, it becomes clear that, though the price of the issue YYY increases from " 100" to "150" and the difference therebetween is "+50", the price of the issue ZZZ remains "80" and the difference therebetween is "0". When the condition information-memory means 65 stores "the difference is more than +20" as a condition, since the issue YYY contained in the message B newly received satisfies this condition, the price of the issue contained in the message B is displayed in a reversal color as shown in FIG.2B.

However, in the aforementioned paging receiver, since a specified portion of the received message is merely displayed in a reversal color when a predetermined condition is satisfied, although the user can recognise that information displayed in a reversal color satisfies the predetermined condition, he cannot know the difference between the newly received message and the formerly received message, that is to say, an extent of increase or decrease of the price. When the user desires detailed information, he must expressly press a scrawl button to read the messages received in the past.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the preferred embodiments of

the invention to provide a wireless communication apparatus which notifies a user of the difference between a message newly-received and a message formerly-received without deteriorating an operational characteristic thereof.

It is a further object of the preferred embodiments of the invention to provide a wireless communication apparatus which notifies a user when a message is read of a passage of time since an arrival of a message, as well as a difference between a message newly-received and a message formerly-received without deteriorating an operational characteristic thereof.

It is a still further object of the preferred embodiments of the invention to provide a method for displaying a message used in a wireless communication apparatus which notifies a user of a difference between a message newly-received and a message formerly-received without deteriorating an operational characteristic thereof.

It is a yet further object of the preferred embodiments of the invention to provide a method for displaying a message used in a wireless communication apparatus which notifies a user when a message is read of a passage of time since an arrival of a message, as well as a difference between a message newly-received and a message formerly-received without deteriorating an operational characteristic thereof.

According to the first feature of the invention, a wireless communication apparatus comprises:

means for receiving a message;

means for storing the message received by the receiving means;

means for displaying the message received by the receiving means or stored in the storing means;

means for controlling the displaying means to display at least

one portion of a message newly-received in a color which is determined in accordance with a result of comparison between the message newly-received and the message formerly-received; and,

means for notifying the arrival of the message.

According to the second feature of the invention, a wireless communication apparatus comprises:

means for receiving a message;

first clock means for counting a time of an arrival of the message;

memory means for storing the message received by the receiving means;

means for reading the message stored in the memory means;

second clock means for counting a time when the message stored in the memory means is read;

means for displaying the message received by the receiving means or stored in the memory means; and,

means for controlling the displaying means to display at least one portion of the message read from the memory means in a color which is determined in accordance with a difference between the times respectively counted by the first and second clock means as well as a result of comparison between the message newly-received and the message formerly-received when the message is read from the memory means.

According to the third feature of the invention, a method for displaying a message used in a wireless communication apparatus, comprises the steps of:

receiving a message;

storing the received message in a memory means;

making a comparison between the message newly-received and the message formerly-received;

displaying at least one portion of the message newly received in a color determined in accordance with a result of the comparison; and,

notifying an arrival of the message.

According to the fourth feature of the invention, a method for displaying a message used in a wireless communication apparatus comprises the steps of:

receiving a message;

counting a time of an arrival of the message by a first clock means;

storing the message and the time of the arrival of the message in a memory means;

reading the message and the time of the arrival of the message from the memory means;

counting a time when the message is read from the memory means by a second clock means;

making a comparison between the message newly received and the message formerly received;

computing a difference between the times respectively counted by the first and second clock means; and,

displaying at least one portion of the message newly-received in a color which is determined in accordance with a result of the comparison and the difference between the times.

BRIEF DESCRIPTION OF THE DRAWINGS

Preferred features of the present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:-

with appended drawings, wherein:

FIG.1 is a block diagram for showing a structure of a conventional wireless communication apparatus,

FIG.2A and 2B show examples of displays of output means of a conventional wireless communication apparatus shown in FIG.1,

FIG.3 is a block diagram for showing an example of an internal structure of a wireless communication apparatus according to the first preferred embodiment of the invention,

FIG.4 shows an example of an internal table of RAM shown in FIG.3,

FIG.5 shows an example of a flow chart for explaining an operation of wireless communication apparatus shown in FIG.3 when a message is received,

FIGs.6A and 6B show examples of internal tables of a primary buffer A, Memory B, an operation buffer A and Memory C shown in FIG.4,

FIGs.7A and 7B show examples of displays of a LCD shown in FIG.4,

FIG.8 is an example of a flow chart for explaining an operation of a wireless communication apparatus shown in FIG.3 when a message stored therein is read,

FIG.9 is a block diagram for showing an internal structure of a wireless communication apparatus according to the second preferred embodiment of the invention,

FIG.10 shows an example of an internal table of RAM shown in FIG.9,

FIG.11 shows an example of a flow chart for explaining an operation of a wireless communication apparatus shown in FIG.9 when

a message stored therein is read, and

FIG.12 shows an example of display of a LCD shown in FIG.9.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Thereafter, preferred embodiments of the invention will be explained referring to the appended drawings.

FIG.3 shows a block diagram for showing an internal structure of a wireless communication apparatus, or desirably a paging receiver, according to the first preferred embodiment of the invention.

In FIG.3, a receiver 2 receives a wireless signal transmitted from a base station (not shown) via an antenna 1, and demodulates it. A decoder 3 decodes the wireless signal demodulated by the receiver 2, and outputs a decoded signal to a CPU4 as a digital signal. An EEPROM 5 previously stores one or more individual IDs, and one or more information IDs. The individual ID is a calling-up number assigned to an individual user, and the information ID is a common calling-up number assigned to an information service. The CPU 4 judges whether the ID contained in the digital signal coincides with the individual ID or the information ID stored in the EEPROM 5. In case that the ID contained in the digital signal coincides with the ID stored in the EEPROM 5, the CPU 4 controls a notification unit 6 to notify the user that the message has been received, and controls a LCD controller 7 to display the message contained in the digital signal on a LCD 8. Moreover, the CPU 4 stores the received messages in the RAM 9 for each ID. The RAM 9 stores the newest message of each information ID as well as the plural messages of each individual ID. Accordingly, whenever the message of the

information ID is newly received, the message of the information ID stored in the RAM 9 is overwritten by the newly received message. When the message is received, the RAM 9 stores the time of reception of the message as a time-stamp data for each information ID on the basis of the time counted by a clock 21.

ROM 10 previously stores display information such as fonts of characters to be displayed on the LCD 8 through the LCD controller 7 as well as a program for controlling the CPU 4.

It is desirable that the decoder 3, the CPU 4, the EEPROM5, the LCD controller 7, the RAM 9 and the ROM 10 are integrated on the same chip.

The notification unit 6, which notifies the user that the message of the individual ID or the information ID has been received, is desirably formed of a loudspeaker, a LED or a vibrator. The user can previously select whether he is notified of the arrival of the message by means of the notification unit 6 or not.

Particularly, since the message of the information ID is received at a predetermined interval in most cases and the number of times of arrivals of the messages of the information ID is comparatively larger than those of the individual ID, it is desirable that the notification unit 6 is so set that it does not operate in case that it receives the message of the information ID. The LCD 8 displays information on the present time and a menu of various functions as well as the received message, and may be replaced with a CRT. When the user desires to read the received message stored in the RAM 9 on the LCD 8, he operates a read switch 11. A reset switch 12 is operated by the user when notification by the notification unit 6, or display of the received message on the

LCD 8, is stopped. A selective switch 13 is operated by the user when various functions and information are selected or the mode of notification is changed.

In the invention, the RAM 9 comprises a memory for storing the received messages for each ID, a primary buffer for temporarily storing a newly received message of the information ID, which will be mentioned in detail afterward, an operation buffer for computing a difference between a previously stored message of the information ID and the same stored in the primary buffer, a table for replacing the result of the aforementioned computation with specific information, a memory for storing the specific information, and a table for replacing the specific information with a color to be used for displaying the message.

FIG.4 is a diagram for showing internal tables of the RAM 9 shown in FIG.3.

In FIG.4, the first memory domain (Memory A, hereinafter) stores the messages of the individual ID for each individual ID. Moreover, Memory A stores a program for controlling the CPU 4, the individual IDs and the information IDs. The second memory domain (Memory B, hereinafter) stores the newest message for each information ID. Moreover, Memory B stores a time-stamp data for each ID. FIG.4 shows a case where the paging receiver deals with three information IDs (ID1, ID2 and ID3). The primary buffer temporarily stores a newly received message of the information ID. The operation buffer A computes the difference between the message of the information ID stored in Memory B and the newly received message of the same information ID which is stored in the primary buffer. The third memory domain (Memory C, hereinafter) stores

information as to which portions of the received message are to be displayed and which colors are to be used for displaying the specified portions of the message, and is provided for each ID stored in Memory B. Accordingly, Memory C is provided for each of three informations IDs (ID1, ID2 and ID3) in this embodiment.

A table B is a conversion table for determining a color to be used for displaying the specified portion of the message on the basis of substituted values stored in Memory C when the message stored in Memory B is displayed. Other domains are used for storing information other than those used for display-control, such as a program, which is temporarily stored to be supplied to the CPU from the ROM, and information on notification, for instance.

Next, an example of operation of the paging receiver shown in FIG.3 at the time of the arrival of a message will be explained referring to FIG.5 to FIGs.7A and 7B.

In FIG.5, when a power-supply is turned on, in other words, the paging receiver is standing-by ready to receive a message, it is judged whether a call is detected or not (step 202). If the call is detected (YES in stop 202), it is judged whether the message newly-received is a message of an individual ID or that of an information ID (step 203).

When the received message is judged to be the message of the individual ID (NO in step 203), the received message is stored in Memory A in RAM 9 (step 214). Then, the notification unit 6 notifies that the call is detected (step 215), and the received message is displayed on the LCD 8 (step 216). When a predetermined time, 20 sec for instance, has passed or the reset switch 12 is operated by the user, notification of the notification unit 6 and

display of the received message on the LCD 8 are stopped (step 217), and the state of standby is recovered.

On the other hand, when the received message is judged to be the message of the information ID (YES in Step 203), as shown in FIG.6A, the received message is temporarily stored in the primary buffer (step 204). In this case, if another message has been already stored in the primary buffer, the primary buffer is overwritten by the newly-received message. Moreover, Memory C in RAM 9 is initialized, and data in all memory addresses become "0" (step 205).

An initialization in Memory C in step 205 is not necessarily conducted. When data is written into Memory C as mentioned later, other data already stored therein is overwritten by the data to be stored.

FIG.6A shows a state where a message "α α (222) ß ß (333)" is newly-received when the received message "α α (105) ß ß (333) has been already stored in Memory B. In this embodiment, it is previously clear that data stored in memory addresses 3 to 5 are numerical data. After Memory C is initialized, a newly received message which is temporarily stored in the primary buffer is compared with the message already stored in Memory B (step 206), and it is judged whether there is a difference between the two aforementioned messages or not (step 207).

When it is judged that there is a difference between the two aforementioned messages (YES in step 207), the difference between the newly received message which is temporarily stored in the primary buffer and the received message which is already stored in Memory B is respectively computed with respect to predetermined portions,

which are contained in brackets (step 212). In an example shown in FIG.6A, the difference is given by "222"-"105"="117" in memory addresses 3 to 5, and the difference "117" is stored in memory addresses 3 to 5 of the operation buffer A as shown in FIG.6B. In memory addresses 11 to 13, the difference is given by "333"-"333"="0", and the difference "0" is stored in a memory address 13 in the operation buffer A.

When the difference between the newly received message which is temporarily stored in the primary buffer and the received message which is already stored in Memory B is computed, the difference is replaced with substituted value on the basis of a table A. The substituted value thus obtained is stored in corresponding addresses of Memory C (step 208). In an example shown in FIG.6B, since the difference "177" in the memory addresses 3 to 5 corresponds to " more than 100" according to the table A, the substituted value becomes "5", which is stored in respective corresponding memory addresses 3 to 5 of Memory C. Since the difference "0" in the memory addresses 11 to 13 corresponds to the substituted value "0" according to the table A, the substituted value "0" is stored in the respective corresponding memory addresses 11 to 13 of Memory C. Since the data of the other memory addresses in Memory C are initialized in step 205, all the data in Memory C become "0" as a result except those stored in the addresses 3 to 5.

When the substituted values are stored in Memory C, the received message which is temporarily stored in the primary buffer is overwritten on the data in Memory B (step 209), and the time-stamp data stored in the Memory B is renewed (step 211). Then, the notification unit 6 notifies the arrival of a new message (step

210), and the received message is displayed on the LCD 8 (step 219). In this case, the received message is displayed in a color corresponding to the substituted value in accordance with the table B. That is to say, a portion of the received message which corresponds to the memory addresses 3 to 5 and stores the data of "222" is displayed in a red color on the basis of the table B because the substituted value corresponding thereto is 5. The remaining portion of the received message is displayed in a black color similarly to usual cases on the basis of the table B, because the substituted value corresponding thereto is "0". FIG.7B shows a suitable example of the above descriptions, where a portion which corresponds to the memory addresses 3 to 5 and stores the data of "222" is displayed in a red color, and the remaining portion is displayed in a black color.

Notification of the arrival of the new message and display of the received message in steps 210 and 219 are stopped when a predetermined time, 20 sec for instance, has passed or the user operates the reset switch 12.

When a newly-received message which is temporarily stored in the primary buffer is compared with the received message which is already stored in Memory B and it is judged that both messages coincide with each other in step 207, for example, when the new message " α α (105) ß ß (333)" is again received when the received message " α α (105) ß ß (333)" is already stored in Memory B, the newly received message which is temporarily stored in the primary buffer is overwritten into Memory B, and the time-stamp data stored in Memory B is renewed. Since the received message is the same as the formerly received message, notification

by means of the notification unit 6 and display on the LCD 8 are not conducted, and the state of standby is recovered. In this case, the user may previously set the paging receiver so that the arrival of a new message is notified by the notification unit 6 and the received message is displayed on the LCD 8. FIG.7A shows a suitable example of display of the newly-received message when the newly-received message is the same as the formerly-received message.

In FIG.8, when the power-supply is turned on, in other words, the paging receiver is standing-by ready to receive a new message, it is judged whether an operation for reading the messages of the individual ID or the information ID is conducted by the user or not (steps 302). For example, the user presses the selective switch 13 to select the ID which he desires to read from the individual ID or the information ID. If the read switch 11 is pressed in condition that desired ID is selected, the message of the desired ID is displayed. When the user has conducted an operation for reading the messages of the individual ID (YES in step 302), the received messages stored in Memory A are displayed on the LCD 8 (step 305). In this case, whenever the user presses the read button 11, the formerly received messages are successively displayed.

On the other hand, when an operation for reading the messages of the information ID is conducted (NO in step 302), the received messages which are stored in Memory B are successively displayed on the LCD 8. In this case, whenever the user presses the read button 11, the received message is successively displayed in the order of ID1, ID2 and ID3. Moreover, the specified portions of the received message are displayed in colors different from those

of other portions on the basis of the substituted values stored in Memory C (step 303). Display of the received message is stopped when a predetermined time, 20 sec for instance, has passed or the user operates the reset switch 12.

As mentioned in the above, according to this embodiment, since the newly received message is compared with the formerly received message and a color used for display is changed in accordance with a difference therebetween, the user can exactly recognize the difference in the newly-received message and the formerly-received message.

Next, a wireless receiving apparatus, or desirably a paging receiver, according to the second preferred embodiment of the invention will be explained, referring to appended drawings.

FIG.9 shows a block diagram of an example of the paging receiver according to this embodiment.

In Figs.9 and 3, the structural elements having the same functions are denoted by the same reference numerals, and detailed explanations thereon will be omitted. In this embodiment, CPU 22 and RAM 23 are provided instead of CPU 4 and RAM 9 shown in FIG.3.

RAM 23 is provided with not only Memories A, B and C, a primary buffer, an operation buffer A and tables A and B, those being respectively provided for RAM 9 shown in FIG.3, but also a table C which determines colors to be used for displaying the message in accordance with a difference between a time of the arrival of a newly-received message and another time when a message stored in a memory is read, in other words a passage of the time since the time of the arrival of the message, as well as the substituted value stored therein.

FIG.10 shows an example of an internal table of RAM 23 shown in FIG.9.

In FIG.10, since the functions of Memories A,B, and C, the primary buffer, the operation buffer A and tables A and B are the same as those shown in FIG.4, detailed explanations thereon will be omitted. The table C stores information as to the colors to be used for displaying the message, which is determined in accordance with the passage of time from the arrival of the message till the message-reading as well as the substituted value stored therein. For example, when the message concerned with the substituted value of "5" is read, if the message is read before 5 hours has passed since the arrival of the message, a portion of the message contained in memory addresses corresponding to the substituted value of "5" is displayed in a red color. On the other hand, in case that the message is read after 5 hours has passed since the arrival of the message, the aforementioned portion is displayed in a black color.

Next, an example of an operation of the paging receiver at the time when the message is read will be explained referring to FIGs.11 and 12.

In FIG.11, in a state that the power-supply is turned on, in other words, in a state of standby, it is judged whether an operation for reading the message of the individual ID or the information ID is conducted by the user or not (step 502).

Since the process in the step 502, and that in the step 505 when an operation for reading the individual ID is conducted by the user are respectively the same as the processes in steps 302 and 305 shown in FIG.8, the detailed explanation thereon will

be omitted.

In the process in step 502, when an operation for reading the message of the information ID is conducted by the user, a difference between the time-stamp data stored in Memory B and the present time counted by the clock 21, that is to say, the passage of time G, is computed (step 507). Then, a color to be used for displaying the message is determined in accordance with the substituted values stored in Memory C for the assigned ID and the passage of time G derived by the computation. As a result, the message is displayed in a color which is determined in accordance with the passage of time since the arrival of the message as well as the difference between the newly received message and the formerly received message (step 503). Display of the received message is stopped when a predetermined time has passed or the user operates the reset switch 12.

FIG.12 shows a state of display of the LCD 8 in an example shown in FIGs.6A and 6B. That is to say, the message "α α (222) ß ß (333)" was newly-received when the received message "α α (105) ß ß (333)" had been already stored in Memory B, and after a while, the message is read by the user. In the example shown in FIG.12, the message is read when 2 hours has passed since the arrival of the message, and "222" is displayed in a red color on the basis of table C.

As mentioned in the above, according to this embodiment, since the color to be used for displaying the message is determined in accordance with the passage of the time since the arrival of the message as well as the difference between the newly received message and the formerly received message, the user can precisely know

freshness of the newly received message, the difference between the newly received message and the formerly received message, and the time of renewal of the message through the color used for displaying the message.

The wireless communication apparatus according to the invention is never restricted to the above mentioned embodiments. For example, although the color used for displaying a specified portion of the message is changed in accordance with the difference between the newly received message and the formerly received message and the passage of time since the arrival of the newly received message in the aforementioned invention, the aforementioned specified portion may be expressed by emphatic characters or covered with non-meshing half-tone instead of changing the color used of display. A brightness of the specified portion may be switched on and off.

The wireless communication apparatus according to the invention may be so constructed that the data stored in RAM 9 or 23, such as color used for character display, a threshold value of the difference in the message or that of the passage of time may be selected by the user or the operator.

Although explanations are given on an example of the paging receiver, the invention can be applied to wireless communication apparatuses of all kinds which can be supplied with information services, such as a portable telephone set or a personal handy-phone system (PHS).

According to the wireless communication apparatus according to the invention, since the newly received message is compared with the formerly received message and a color used for displaying the

newly-received message is changed in accordance with the difference between the two aforementioned messages, the user can precisely know the difference between the newly-received message and the formerly-received message through a colour used for displaying the message.

Moreover, since a colour used for displaying the message can be changed in accordance with the passage of time since the arrival of the message, the user can also precisely recognize freshness of the message and the time of renewal of the message.

Although the invention has been described with respect to specific embodiments for complete and clear disclosure, the appended claims are not to be thus limited but are to be construed as embodying all modifications and alternative constructions that may occur to one skilled in the art and which fairly fall within the basic teaching herein set forth.

Each feature disclosed in this specification (which term includes the claims) and/or shown in the drawings may be incorporated in the invention independently of other disclosed and/or illustrated features.

The text of the abstract filed herewith is repeated here as part of the specification.

A newly-received message is compared with a formerly-received message which is stored in a memory. At the time of the arrival of the newly-received message, a portion of the message that is unchanged as compared to the formerly-received message is displayed the same way as usual, but the other portion, in which the message is changed, is displayed in a different colour in accordance with the difference of the newly-received message and the formerly-received message.

CLAIMS:

1. A wireless communication apparatus, comprising:

means for receiving a message;

means for storing said message received by said receiving means;

means for displaying said message as newly-received by said receiving means or as formerly-received and stored in said storing means;

means for controlling said displaying means to display at least one portion of the message newly-received in a colour which is determined in accordance with a result of comparison between said message newly-received and said message formerly-received; and,

means for notifying said arrival of said message.

2. A wireless communication apparatus according to claim 1, further comprising:

means for reading said message stored in said storing means; wherein said controlling means controls said displaying means to display said at least one portion of said message read from said storing means in a colour determined in accordance with a predetermined value.

3. A wireless communication apparatus according to claim 2, wherein said notifying means comprises first clock means for counting a time of arrival of said newly-received message;
wherein said wireless communication apparatus further comprises

second clock means for counting a time when said formerly-received message in said storage means is read; and,

wherein said controlling means determines the display colour of the at least one portion of said newly-received message additionally in accordance with a result of comparison between said times respectively counted by said first and second clock means.

4. A wireless communication apparatus according to claim 1, 2 or 3, wherein:

said controlling means comprises:

means for generating a predetermined value depending on said result of said comparison;

means for loading said predetermined value; and,

means for determining said colour for displaying said at least one portion in accordance with said predetermined value.

5. A wireless communication apparatus according to claim 1, 2 or 3, wherein said a least one portion of said message newly-received is different from that of said message formerly-received.

6. A wireless communication apparatus according to claim 1, 2 or 3, wherein said apparatus is a paging receiver.

7. A method for displaying a message used in a wireless communication apparatus, comprising the steps of:

receiving a message;

storing said received message in a memory means;

making a comparison between a message newly-received and a

stored message formerly-received;

displaying at least one portion of said message newly-received in a colour determined in accordance with a result of said comparison; and,

notifying an arrival of said newly-received message.

8. A method for displaying a message as defined in claim 7, wherein:

said step of displaying said at least one portion of said message comprises the steps of:

generating a predetermined value depending on said result of said comparison;

storing said predetermined value depending on said result of said comparison;

storing said predetermined value in a storing means; and,

determining said colour used for displaying said at least one portion of said message newly-received in accordance with said predetermined value.

9. The method for displaying a message as defined in claim 8, further comprising the steps of:

storing said message to be displayed in said memory means, together with said predetermined value;

reading said message stored in said memory means; and,

displaying said at least one portion of said message read from said memory means in a colour determined in accordance with said predetermined value.

10. The method for displaying a message as defined in claim 7, wherein said notifying step comprises counting a time of arrival of said newly-received message by a first clock means;
wherein said method for displaying a message further comprises the steps of:

reading said message and said time of arrival of said message from said memory means;

counting a time when said message is read from said memory menas by a second clock means; and,

computing a difference between said times respectively counted by said first and second clock means; and,
wherein said displaying step determines the colour of said newly-received message additionally in accordance with a result of said difference between said times.

11. A method for displaying a message as defined in any one of claims 7 to 10, wherein at least one one portion of said message newly-received is different from that of said message formerly-received.

12. A method for displaying a message as defined in any one of claims 7 to 10, wherein said wireless communication apparatus is a paging receiver.

13. A wireless communication apparatus substantially as herein described with reference to and as shown in Figures 3 to 12 of the accompanying drawings.

14. A method for displaying a message used in a wireless communication apparatus, the method being substantially as herein described with reference to and as shown in Figures 3 to 12 of the accompanying drawings.

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Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.R): G4H(RCU); H4L(LDPP, LESF, LEUF)

Int Cl (Ed.7): G06F(17/60); G08B(5/22); H04L(12/58); H04Q(7/22, 7/38)

Other: ONLINE: WPI, PAJ, EPODOC, IEEE ELECTRONIC LIBRARY

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
A	GB 2314439 A	(NEC) See whole document.	
X,Y	GB 2303725 A	(NEC) See whole document.	X(1,2,6-9,12) Y(3, 10)
X	GB 2242048 A	(NEC) See whole document.	1 and 7, at least
Y	WO 99/18552 A	(MOTOROLA) See abstract.	3 and 10
A	US 5765178	(FUJI) See whole document.	

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